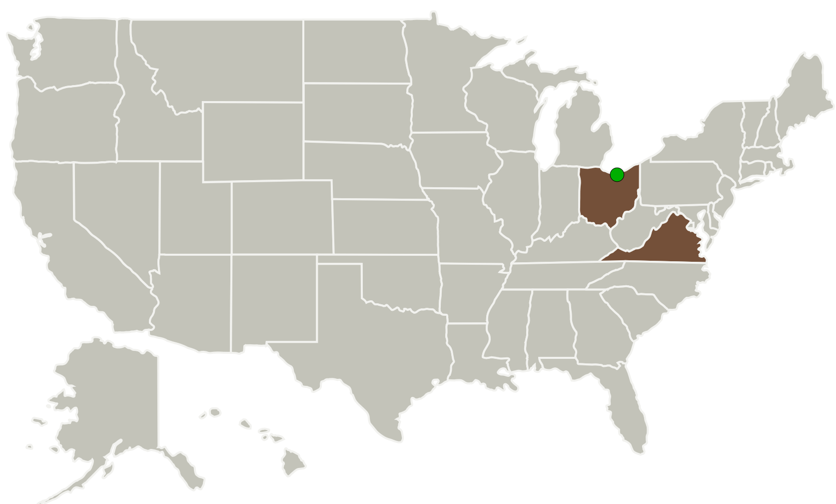
Quantum Effect Materials and Devices for Future Communication Systems, Phase I

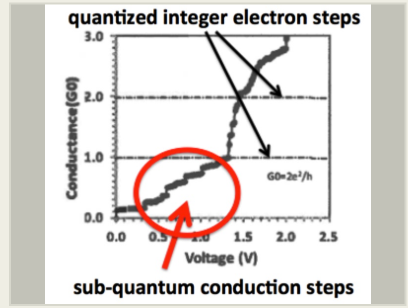
Completed Technology Project (2017 - 2017)

Project Introduction

NanoSonic proposes to design, fabricate and demonstrate the performance of optical detectors that use multiple quantum material effects to overcome fundamental microelectronic device limits. Through prior research, NanoSonic has fabricated single-element optical detectors and theoretically and investigated several quantum material behaviors separately. Here we would combine these technologies into a single device to serve as a "pathfinder" for future quantum materials research and product development. NanoSonic would work with researchers in the Department of Physics at Virginia Tech, and microelectronics scientists at a major US electronics company to analyze and build the devices, and demonstrate the quantum principals on which they are based. Our proposed prototype detectors will incorporate the following quantum effects. - Sub-quantum electron transport associated with ballistic electron transport leading to decreased conductor resistances and thermal losses, and in part overcomes Moore's Law - Resonant sub-optical wavelength antennas that treat incoming optical signals as waves instead of photons - Metal nanocluster surface plasmon resonance effects to increase detector efficiency - Tunable bandgap quantum dot detectors that exhibit Multiple Electron Generation effects and quantum efficiencies QE>1 NanoSonic has investigated and published observations of the basic physics of some of these effects. During Phase I we would design, fabricate, test and deliver first-generation materials and devices to NASA, and work with electronics company device engineers to consider how these technologies may be transitioned to future communication system hardware.

Primary U.S. Work Locations and Key Partners





QUANTUM EFFECT MATERIALS AND DEVICES FOR FUTURE COMMUNICATION SYSTEMS, Phase I Briefing Chart Image

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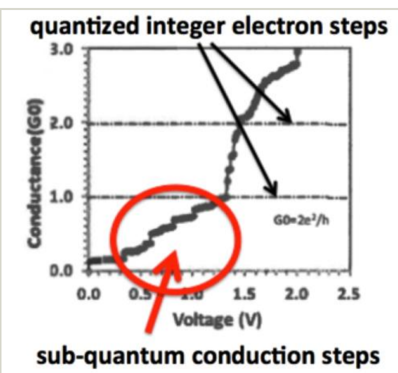
Organizations Performing Work	Role	Type	Location
Nanosonic, Inc.	Lead Organization	Industry	Pembroke, Virginia
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Virginia

Images



Briefing Chart Image
QUANTUM EFFECT MATERIALS AND DEVICES FOR FUTURE COMMUNICATION SYSTEMS, Phase I Briefing Chart Image
(https://techport.nasa.gov/image/129842)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Nanosonic, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Richard O Claus

Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**

1 2 3 4 5 6 7 8 9

Applied Research | Development | Demo & Test

Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - └ TX05.4 Network Provided Position, Navigation, and Timing
    - └ TX05.4.2 Revolutionary Position, Navigation, and Timing Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System